

# Food availability and food and nutrition (in)security of families providing for the National School Feeding Program

## *A disponibilidade de alimentos e a (in)segurança alimentar e nutricional de famílias fornecedoras do Programa Nacional de Alimentação Escolar*

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### ABSTRACT

#### Objective

The objective of the study was to evaluate the availability of food and the situation of food and nutritional (in)security in families of farmers who provide for the National School Feeding Program.

#### Methods

This is a cross-sectional study with families of farmers who supplied *Programa Nacional de Alimentação Escolar* from 2011 to 2016 in the city of Viçosa, Minas Gerais, Brazil. To assess Food Insecurity, the Brazilian Food Insecurity Scale was applied to the person responsible for purchasing and producing meals in the family. The nutritional aspect was analyzed through the measurement of hemoglobin to check for anemia among family members and using the household food availability survey, where it was possible to analyze the amount of calories available for consumption, as well as the origin and kind of food.

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## Results

27 families were evaluated, totalizing 91 individuals. With the *Escala Brasileira de Insegurança Alimentar*, it was found that 25.9% of the families were in light food insecurity situation. When caloric availability was assessed, 11.0% of families were considered insecure. In contrast, 59.0% of families had high calorie availability *per capita* (>3000 calories). Of the total households, 14.8% had more than 50.0% of the calories available for consumption coming from their own production. The foods most commonly produced for self-consumption were fresh vegetables, which are the most common ones supplied to *Programa Nacional de Alimentação*. In addition, the main source of kilocalories for the families were fresh and minimally processed foods. The presence of anemia in at least 1 resident was detected in 29.6% of households, with a negative correlation between the hemoglobin value (g/dL) and the *Escala Brasileira de Insegurança Alimentar* score.

## Conclusion

It appears that the majority of the families of farmers supplying *Programa Nacional de Alimentação Escolar* are in a situation of Food and Nutritional Security, both by *Escala Brasileira de Insegurança Alimentar* and by the household availability of food. However, we cannot ignore the percentage of insecure families, since this situation can lead to other problems. Therefore, it is necessary to constantly assess the family situation of Food Insecurity and encourage production for self-consumption so that it contributes to food availability and quality. For this reason, we highlight relevance of programs that strengthen the production and commercialization of food from family farming.

**Keywords:** Food and nutritional security. Rural Areas. School feeding.

## RESUMO

### Objetivo

O objetivo do estudo foi avaliar a disponibilidade de alimentos e a situação de (In)Segurança Alimentar e Nutricional em famílias de agricultores fornecedores do Programa Nacional de Alimentação Escolar.

### Métodos

Trata-se de um estudo transversal com famílias de agricultores fornecedores do Programa Nacional de Alimentação no período de 2011 a 2016 em Viçosa, Minas Gerais, Brasil. A Escala Brasileira de Insegurança Alimentar foi aplicada ao responsável pela compra e produção de refeições na família para avaliação da Insegurança Alimentar. Analisou-se o aspecto nutricional por meio da dosagem de hemoglobina para verificação de anemia entre os membros da família e utilizando-se o inquérito de disponibilidade domiciliar de alimentos, o que permitiu analisar a quantidade de calorias disponíveis para consumo, assim como a procedência e o tipo do alimento.

### Resultados

Avaliaram-se 27 famílias, totalizando 91 indivíduos. Com a Escala Brasileira de Insegurança Alimentar, constatou-se que 25,9% das famílias encontravam-se em situação de Insegurança Alimentar, sendo todas consideradas de Insegurança Alimentar leve. Quando avaliada a disponibilidade calórica, 11,0% das famílias estavam inseguras. Em contrapartida, 59,0% das famílias apresentaram disponibilidade calórica *per capita* alta (>3.000 calorias). Do total das famílias, 14,8% possuíam mais de 50,0% das calorias disponíveis para consumo advindas de produção própria. Os alimentos mais produzidos para autoconsumo foram os vegetais *in natura*, que são os mais fornecidos ao Programa Nacional de Alimentação Escolar. Além disso, a principal fonte de quilocalorias das famílias eram alimentos *in natura* e minimamente processados. A presença de anemia em pelo menos 1 morador foi detectada em 29,6% dos domicílios, havendo correlação negativa entre o valor de hemoglobina (g/dL) e a pontuação da Escala Brasileira de Insegurança Alimentar.

### Conclusão

Verifica-se que a maioria das famílias de agricultores fornecedores do Programa Nacional de Alimentação Escolar encontra-se em situação de Insegurança Alimentar, tanto pela Escala Brasileira de Insegurança Alimentar, quanto pela disponibilidade domiciliar de alimentos. Contudo, não se pode desconsiderar o percentual de famílias inseguras, uma vez que esse quadro pode levar a outros agravantes. Logo, faz-se necessária a constante avaliação da situação familiar de (in)Insegurança Alimentar e incentivar a produção para autoconsumo para que esta contribua para a disponibilidade e a qualidade alimentar. Por isso a relevância de programas que fortaleçam a produção e comercialização de alimentos da agricultura familiar.

**Palavras-chave:** Segurança alimentar e nutricional. Zona rural. Alimentação escolar.

## INTRODUCTION

Food and Nutritional Security (FNS), defined by Brazilian Law n. 11346/2006, comprises “the regular and permanent access to quality food in sufficient quantity and without harming the access to other basic needs; it should be socially, culturally, economically, and environmentally sustainable” [1]. Access to food is a basic need expressed by the *Direito Humano à Alimentação Adequada* (DHAA, Human Right to Adequate Food). However, the scarcity of food and Food and Nutritional Insecurity (FNI) are still problems of global proportions. Data from the United Nations (UN) reveal that in 2018, one in nine people in the world did not have enough to eat [2].

Considering the situation of Food Security (FS) in Brazil, the 2013 *Pesquisa Nacional de Amostras por Domicílios* (PNAD, National Household Sample Survey) analyzed 65,3 million private homes using the *Escala Brasileira de Insegurança Alimentar* (EBIA, Brazilian Food Insecurity Scale). It detected severe Food Insecurity (FI) in 3.2% of the studied population, reflecting experiences of hunger during the investigated period. Most people in that condition were in rural areas, not in urban ones [3].

Food and Nutritional Insecurity is found where there is food scarcity and specific situations of nutritional need, resulting in a public health problem, especially for developing countries [4]. One of its correlated deficiencies are anemia, which affects about 1,620 million people in the world [5]. The growing prevalence of overweight and Chronic Non-Communicable Diseases (CNCD) is also connected to conditions of FNI, indicating qualitatively inadequate nutrition. The frequent and routine consumption of fruits and vegetables is among the factors that protect against such conditions [6].

Opposingly, nutrition quality reflects FNS conditions. According to the results of the 2018 edition of the research *Vigilância de Fatores de Risco e Proteção para Doenças Crônicas por Inquérito Telefônico* (VIGITEL, Surveillance of Risk and Protective Factors for Chronic Diseases), only 23.1% of the Brazilian adult population ( $\geq 18$  years-old) consumes fruits and vegetables according to medical guidelines. Data from the 2013 *Pesquisa Nacional de Saúde* (PNS, National Health Research) reveal that people in rural areas consume even less fruits and vegetables than people in urban areas – a disturbing fact considering that most crops are produced in rural areas [6,7].

Socioeconomic indicators are connected with the situation of FNI and are intensified in rural areas due to the low levels of education, income, and development, besides higher rates of poverty, poor distribution of land, and reduced access to public policy [8,9]. Family farming is developed within this context.

Food and Nutritional Security requires the promotion of varied and regular nutrition in sufficient quantity and every day, which involves the production and access to food, as well as the prioritization of more sustainable growth. In that sense, Brazilian public policy combining nutrition and family farming, such as the Programa de Aquisição de Alimentos (PAA, Food Acquisition Program) and the *Programa Nacional de Alimentação Escolar* (PNAE, National School Feeding Program), are strategically aimed at the combat of FNI, especially among farmers [10].

*Programa Nacional de Alimentação Escolar*, specially, encourages the consumption of fresh food for over 40 million students and strengthens the family-based agri-food system. Its connections to family farming promotes the consolidation of FNS and DHAA by dynamizing income and the production of food in rural areas, specially fresh and locally-produced food, improving the quality of its beneficiaries' nutrition and contributing to farmer families [11]. Thus, the inclusion of family farming in PNAE boosts progress in goals related to the agricultural sector's nutrition and to public health [12]. Its potential in promoting family farming and food sovereignty for rural communities – specially as it stimulates varied production for commercialization and self-consumption, thereby increasing access to food, reducing dependence on commerce, and promoting food availability – should also be highlighted [13].

Therefore, it is pertinent to quantify food availability in families of farmers who participate in this important FNS program, analyzing the origins and the quality of their food, their health conditions, as well as evaluating the food groups available for consumption as factors promoting FNS in rural areas. This study portrays different reads of FNS through food perception, situations of anemia, and food availability, considering both the production for self-consumption and the food groups available to families. It also assesses the negative and positive points of the methods employed. Its main objective was to evaluate food availability and the situation of Food and Nutrition (In)Security (FNI) in families of farmers who supply PNAE.

## METHODS

This is a cross-sectional study with families of farmers in the city of *Viçosa*, in the state of *Minas Gerais*, Brazil, that supplied local schools with food from 2011, when the municipality began employing family farming production for its public supply, to 2016. We evaluated all the families where one or more members supplied the schools through PNAE at any point between those years, resided in the municipality, and consented with the participation. The farmers and their families were found through the City Hall's reports of supply from 2011 to 2016. Contact with the families was facilitated by the local *Empresa de Assistência Técnica e Extensão Rural* (EMATER, Rural Extension and Technical Support Company).

To investigate Food (In)security, we used the *Escala Brasileira de Insegurança Alimentar* (EBIA, Brazilian Food Insecurity Scale), which was applied to the person responsible for the purchase and production of meals in the family [3]. The Scale applies objective questions aimed at gathering the family's perceptions of their own access to food. It allows the classification of the family as safe or unsafe within three different levels of insecurity (light, moderate, and severe) depending on the number of occurrences of a set of described situations in the last 90 days prior to the visit. The questions involve concerns related to the lack of food, the quality of food, and the effective lack of food in the house [3].

The nutritional part of the study assessed the domestic availability of food in the 30 days prior to the interview, as well as the origin of the food – if it was self-produced, purchased, donated, or exchanged. The survey consisted of a list of previously established foods, according to the methodology of Galeazzi *et al.* [14]. The interviewer filled out information regarding the food's origin and quantity available for 30 days in kilograms, according to the report of the interviewed, who was the member of the family responsible for the purchase and production of the family's meals. The survey sought to understand the studied population's eating habits. As typical and local foods were said to be available for consumption by the interviewees, they were added to the list. For the most part, these were unconventional plants.

We converted the food measured in units of weight into calories using the software *Avanutri*® 4.0. and inferred the daily per capita calorie availability by dividing the total kilocalories available for the family by 30 days and, afterwards, by the number of people in the houses [15,16]. To classify the family's status regarding calorie availability, we adopted the method in Smith and Subandoro [17]. Thus, families with a calorie availability below 2500Kcal *per capita* a day were considered to be in FNI situation. Values between 2500 and 3000Kcal *per capita* a day corresponded to average calorie availability and values above 3000Kcal *per capita* a day indicated high calorie availability. With the analysis of availability, it was also possible to classify the available food into fresh, minimally processed, processed, ultra-processed, and culinary ingredients, as determined by the 2014 Dietary Guidelines for the Brazilian Population [18].

The presence of anemia in the members of the studied families was also assessed. We drew a drop of blood in order to dose hemoglobin with the portable meter *HemoCue*®. The collection was carried out in the person's home and analyzed for anemia applying the World Health Organization (WHO) cut-off points considering sex and age groups [19].

Data was tabulated in Microsoft® Office Excel 2013 and the statistical analysis was done with IBM SPSS 2.0. We verified the distribution of variables according to normality using the Kolmogorov-Smirnov test and considering  $p < 0,05$  and sought the association between qualitative variables using the Chi-Square test, as in: FI given by EBIA and FI given by food availability; FI by both methods and the presence of anemia. We calculated the Spearman correlation for FS, which was given by the punctuation of EBIA, food availability in kcal, and anemia measured by the values of Hemoglobin (Hb). Volunteers who participated in the research signed an Informed Consent Form. Minors (under 18 years old) had their voluntary participation in the study authorized by their legal guardians through a signed Consent Form.

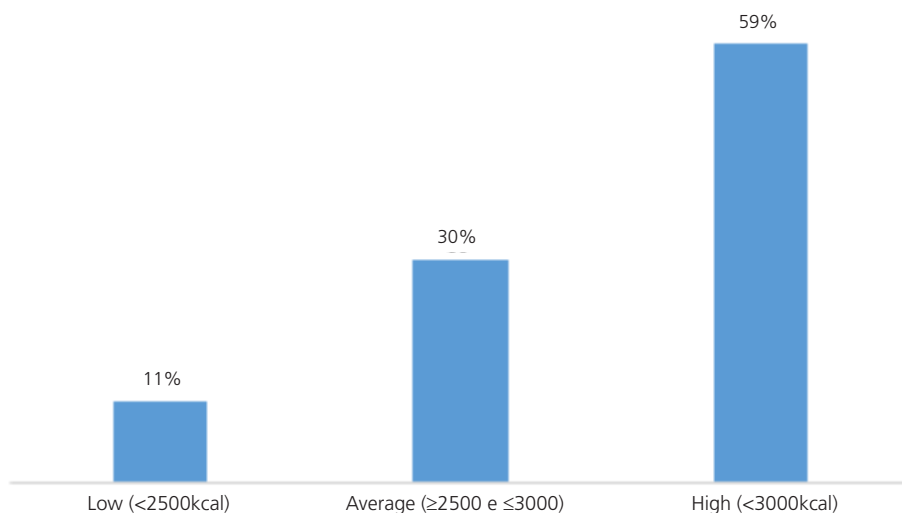
The study originated from a master's degree research registered in SisPPG-UFV under the process number 40502269349 and approved by the Human Research Ethics Committee of the *Universidade Federal de Viçosa* (MG) (n. 1.881.839) [20]. The data collection was carried out in 2017.

## RESULTS

We visited 27 families of farmers who supplied PNAE, totalizing 91 individuals. All the visited families accepted participating in the research. Most participants, 50.5% (n=46), were women. As to the age groups, 61.4% (n=56) were adults, 18.6% (n=17) were old-aged, 20.0% (n=18) were children and teenagers (<20 years old).

Evaluations based on EBIA revealed that 25.9% (n=7) of the families showed light FI, which comprises the fear or concern of lacking food. No moderate or severe FI situation was recorded. Calorie availability was assessed according to the methodology of Smith and Subandoro [17] and the results are presented in Figure 1. The evaluation with EBIA shows a larger number of insecure families than the assessment of food availability. We did not find any association between the results of both methods.

Analyzing the origin of the total available calories – whether the goods had been bought, donated or self-produced – showed that all families produced for self-consumption. The impact of that production in the total food availability varied from 4.8% (smallest value) to 62.0% (largest value). 14.8% (n=4) of



**Figure 1.** Classification of families according to daily *per capita* calorie availability. Viçosa (MG), Brazil, 2017.

the families had more than 50.0% of their calories coming from production for self-consumption, mainly of food of vegetal origin (fruits, vegetables, leaves), which represent most of PNAE's commerce. There was also production of food of animal origin. These families were safe due to the availability of food and only one of them was insecure according to EBIA. In the three families with low per capita calorie availability, the production of food for self-consumption was also low – less than 20.0% in two of them (18.7% and 19.5%) and 39.2% in the third. This highlights the importance of production for self-consumption, which impacts on the availability of foods and on the promotion of FNS.

However, the quality of the available calories should also be considered, as 33% of the families (n=9) used lard, considered an ingredient, as a product for self-consumption. This is usual in rural areas and this product contributes considerably for the total calories. Opposingly, the production of fresh foods like fruits and vegetables for self-consumption, also a reality for family farmers, does not contribute heavily with the calorie availability, as these are low-energy-density foods.

During the food's categorization as fresh or minimally processed, processed, ultra-processed foods, and culinary ingredients, as proposed by the 2014 Dietary Guidelines, we observed that in all families, fresh or minimally processed foods represented over 45% of the monthly calorie intake [18]. However, processed and ultra-processed foods were part of the calorie availability of rural families and there was a relevant amount of calories that originated from culinary ingredients (salt, sugar and fats), as can be observed in Table 1. This is possibly due to the large stocks (in kg) they kept both of sugar (from 1 to 25kg) and oils and fats with high caloric density (9Kcal/g), which varied from 0.9 and 10.8kg.

**Table 1.** Distribution of the monthly calorie availability per family, according to the food group classification of the Dietary Guidelines for the Brazilian Population. *Viçosa (MG), 2017.*

Values	% Kcal of fresh or minimally processed foods	% Kcal of processed or ultra-processed foods	% Kcal of culinary ingredients
Median	63.9	13.6	22.5
Minimum	47.1	2.6	9.7
Maximum	78.0	32.3	33.6

Note: n=27 families.

Out of all the families, 29.6% (n=8) had at least one inhabitant with anemia. This condition was not associated with insecurity defined by EBIA and/or by the daily calorie availability. Nevertheless, there was a negative correlation between the values of hemoglobin (g/dL) and the punctuation of EBIA ( $r=-0.218$ ;  $p=0.039$ ) – that is, in families where the EBIA punctuation was higher, indicating FI, the hemoglobin values of the family members was lower.

## DISCUSSION

This study with EBIA found light FI among the families who supplied PNAE. A study carried out in the same region and using the same instrument found a larger prevalence of light and moderate FI (38.7%) [21]. The families in that study did not participate in PNAE, which suggests the program's influence in promoting FS. Besides its direct income collaboration, PNAE stimulated the family's food production, thus generating surpluses for self-consumption, which might improve the perspective of FI [22]. However, we should also look into the origins of the food and check if the food groups available in a FNS context are present.

More families are considered insecure when applying EBIA than when using household food availability surveys. This suggest that despite having sufficient kilocalories available, some households fear

the lack of food for subsistence. We highlight the differences between the methods and their limitations, which justify the need to use more than one measure to investigate FNS.

In terms of the level of subjectivity in the methods, EBIA is susceptible to interpretations of “prestige” or “benefit” when interviewees think they might gain or lose some sort of help depending on their answers. Besides, the same scale is used to classify different populations, which might end up misrepresenting the reality of these populations. It also makes EBIA unfit for measuring individual FI. These factors impose that EBIA is used along with other methodologies, such as household food availability [23,24].

High calorie availability was found in 59% of the families, showing that most of them had access to food in energetic density superior to their daily needs. The quality and origin of those calories has to be considered, as access to processed and ultra-processed foods is high in rural areas, possibly contributing to overweight [25]. According to the 2008-2009 *Pesquisa de Orçamentos Familiares* (POF, Survey of Family Budgets), 38.8% men and 47.9% women in the rural area presented some level of excessive weight, and 8.8% of the men and 16.5% of the women were considered obese [26]. These facts shows that rural and urban populations have similar nutritional profiles [27]. Opposingly, the studied environment also showed lower availability of food, which evidences how heterogenous this population (and the general Brazilian reality) is. The problem of hunger in Brazil is not a reflex of its weak productive capacity; in fact, it reflects the inefficiency of its agri-food regime in distributing food and guaranteeing “equality and social justice, as well as environmental sustainability” [28].

Production of food for self-consumption might contribute to improve families’ income and FNS in rural areas by granting access to fresh local food and separating it from monetary acquisition [18]. Likewise, families with over 50% of their available calories coming from self-production found themselves more secure within EBIA. Production for self-consumption reduces food vulnerability and poverty in rural areas. Productive yards and small areas guarantee the direct access to diversified foods and represents a source of non-monetary income, as families save money by consuming their own production, generating “relative independence toward market imposition of buying products” [29,30].

Diversified production for self-consumption might be indirectly stimulated by the opening of markets for the outlet of family farming products, as PAA and PNAE, with important reflections on family consumption [31]. In the studied population, most food products used for self-consumption are the same that were supplied to PNAE. A study on the relations between the program and family farming indicated positive outcomes for such relations, such as increasing the amount and the variability of the production, improving farmers’ incomes and quality of life, and providing benefits for the school meals with the larger supply of fresh fruits and vegetables [11].

However beneficial the policy is for its suppliers and consumers, it also presents particular difficulties related to the hygienic-sanitary quality of products, logistic of distribution, delayed payments for the goods, among others. These issues must be addressed for the policy to move forward [20].

A study in other municipality of *Zona da Mata* (forest area) in the state of Minas Gerais showed that PNAE collaborated for the diversification of regional production and generated increases in the income of its suppliers [32]. It is possible to infer that diversified production and increased incomes might contribute decisively to these families’ qualities of life and, consequently, to their FNS.

According to Louzada *et al.* [33], there are recent transformations in the patterns of consumption of both rural and urban areas, with increased consumptions of ultra-processed foods when compared to fresh or minimally processed foods. Nevertheless, as the present study evaluated the consumption of available food groups, it showed an evident predominance of fresh and minimally processed foods (Table 1), as the 2014 Dietary Guidelines recommend for a nutritionally balanced diet [18]. Preference to organic and/or

agroecologically-based foods is also suggested, which favors family farming and promotes a socially and environmentally sustainable agri-food system [18]. Usually, rural areas are seen as promoters of health, as they detain the possibilities of cultivation. Thus, it is important to foster agricultural practices and production for self-consumption [21].

A populational study in Australia concluded that ultra-processed foods contributed with 42% of people's total calorie ingestion, being their main energy source [34]. These results also included the greater consumption of nutrients related to CNCD like sugars, fats, and sodium, and the reduced ingestion of fibers and potassium [34]. This situation is characterized as hidden hunger, given the low ingestion of micronutrients [35]. In that sense, the present study shows positive results related to the greater availability of fresh and minimally processed foods in the evaluated families.

Anemia also indicates FNI situations. The study carried out by Lopes [21] in a rural community in *Minas Gerais Zona da Mata* showed the association between anemia and FI ( $p=0.049$ ). A research in Bangladesh with 5,666 women of child-bearing age identified that FI, measured by a scale similar to EBIA, increased the chance of anemia by 57% [36]. That situation was not found in our study. However, as the punctuation of EBIA increased, a larger value of hemoglobin was found in the inhabitants.

Food and Nutritional Insecurity and/or lower socio-economic levels associate with the more frequent consumption of food rich in carbohydrates, which generally have lower acquisitive values, as opposed to food rich in protein and heme iron, of better bioavailability [37]. Thus, generating family income may contribute with the quality of nutrition.

Using both methods, EBIA and household food availability, for evaluating the situation of families regarding FNI issued different results. However, FNS is a complex phenomenon and EBIA alone is not sufficient to measure its full nutritional aspect. There may be various determinants of FNI, which may also interfere in results as different methodologies are applied [38]. When nutritional factors are evaluated, other situations of insecurity different from the one identified by EBIA are revealed, which shows the need to include these indicators in the investigation of FNI. Evaluation by EBIA shows the overall family situation and it impacts all the individuals in it. Consequently, using more than one methodology allows the analysis of factors associated to the intra-familial FNI situation, contributing to its detection [38].

As a positive aspect of the study, we highlight the use of different methods to amplify, understand, and, as a consequence, evaluate the FNS situation. It also allowed the identification of production for self-consumption and the food groups available for families.

Its most fragile point is the families perceptions of their own situation of nutritional (in)security, where light FI situations were found. Many families, specially rural ones, are marked by a past of restriction that make them insecure regarding the maintenance of good nutritional situations. This might become less relevant as economic development in a sustainable and distributive fashion guarantees FNS for the present and the next generations; or else, with the lack of economic perspective, it might become even more acute.

Finally, production for self-consumption is a relevant and possible tool enabling families' FNS, with fresh foods playing a specially important role. As such, it should be added to the efforts of social public policies.

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## CONCLUSION

While most families who supply PNAE find themselves in a FNS situation, the percentage of insecure families should not be taken for granted. It is necessary to recognize the determinants of FNI in local



perspectives to base public policies that meet the needs of those families, supporting the cultivation and commercialization of food as well as generating and increasing income, as is done by PNAE. The heterogeneity of the studied families and of the perceptions and evaluations of FNS also account for the need of complementary instruments for investigating FNI. Anemia is also a relevant factor and it evidences the need of prevention and treatment actions.

As a conclusion, we stress the quality of nutrition of the families who supply PNAE, as a larger availability of fresh and minimally processed foods was verified within that program. It is possible that the greater availability of such foods reflect on the nutritional consumption, which also highlights the importance of self-production in terms of income generation and quality of nutrition, thus contributing to families' FNS.

## CONTRIBUTORS

FAM CALIXTO worked in data collection, and in the conception, writing, and revision of the article. PT TRIVELLATO contributed to the data collection, writing, and revision of the article. ES MIGUEL carried out the data analysis and the revision of the article. SE PRIORE worked in supervising, writing, and revision of the article.

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